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HOME CANNING OF FRUITS VEGETABLES AND MEATS

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HOME CANNING OF FRUITS, VEGETABLES, AND MEATS

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INTRODUCTION

CANNING is a method of using heat and airtight containers to preserve food as nearly as possible in the condition in which it is served when freshly cooked. It is a desirable and economical method of preserving many foods so that their use can be distributed over seasons and to places where they are not available fresh. Canned foods thus make possible a better-balanced and more-varied diet throughout the year.

The method of canning foods affects the vitamin content to some extent. With the possible exception of vitamin C there may be no serious loss during the canning process, though of course when foods are removed from the cans and reheated before serving, there may be additional loss of vitamins. In order to preserve all the vitamins possible in canned products, emphasis is placed throughout this bulletin on canning foods very soon after they are gathered and on carrying every step of the process through rapidly. Precooking foods for a short time, packing them hot, and processing them in the containers help to preserve the vitamin value.

None of the minerals in foods need be lost in canning, providing the liquid in which they are precooked is used to fill up the containers and provided the entire contents of the can is served.

A canning budget prepared at the beginning of the season will indicate what quantities of different canned foods are needed by the family. In making such a budget, consider the number of persons in the family, the length of time that fresh foods are out of season, and what foods are available for canning, as well as the cost of equipment and containers, and the value of the time of the persons doing the work. Assistance in planning a canning budget suitable to the locality and adapted to the nutritional requirements of the family may be obtained from the State college of agriculture.

PROCESSING TO DESTROY ENZYMES AND MICRO-ORGANISMS

Successful canning is based on an understanding of the important causes for the rapid spoilage of fresh foods and on a knowledge of the methods by which this spoilage may be prevented. The two agents that cause food spoilage are enzymes and micro-organisms, including bacteria, yeasts, and molds.

ENZYMES

All fresh fruits, vegetables, and meats contain substances called enzymes. Up to a certain point these enzymes bring about desirable changes in foods. They cause fruits and vegetables to ripen normally and the tissues of meats to become more tender as they are held in storage; but if allowed to go on unchecked, enzymes hasten the decay of foods. The low temperatures of cold storage retard the action of enzymes, and the heat of cooking or canning destroys them entirely.

To prevent undesirable changes due to enzymes, fruits and vegetables should be canned as soon as possible after they are gathered. "Two hours from garden to can", is a good rule. If they must be held they should be kept in small lots in a cool, well-ventilated place. Meats should be refrigerated at 30° to 32° F. if they are to be held for several days.

MICRO-ORGANISMS

The second and more important cause of food spoilage is the action of three groups of minute organisms that are present in the air, soil, water, and, in fact, on everything. They are yeasts, molds, and bacteria.

If all micro-organisms in food are killed and it is sealed steaming hot in sterile airtight containers, it is said to be sterilized. The application of heat to foods during canning in order to kill micro-organisms is called processing. Food spoils when it comes in contact with unheated air because of the bacteria, yeasts, and molds the air contains. For successful canning it is not enough just to destroy the micro-organisms. After processing, the food must be protected from the air by a hermetic seal.

YEASTS AND MOLDS

Yeasts and molds are easily destroyed by heat in canning. Temperatures below the boiling point of water (from about 150° to 180° F. for varying periods of time) are effective in destroying them. Yeasts rarely cause spoilage in canned foods, and molds never do unless the container holding the food is faulty and permits the organisms to gain entrance from the air.

BACTERIA

In killing bacteria by heat both the degree of temperature and the length of time it is to be applied must be considered. A very high temperature may produce a sterile canned product that will keep well, but this may be at too great a sacrifice of flavor and texture. Therefore the temperature applied should ordinarily be the lowest and the period of time the shortest necessary to accomplish the desired result. This may not in every case actually sterilize the food, but it does give "effective sterilization", by destroying the organisms that are likely to grow and cause spoilage when the food is stored under average conditions.

While bacteria are growing actively they are easily destroyed at the temperature of boiling water (212° F.). But some kinds of bacteria go through a dormant or spore form in the course of their life cycle, and in that stage are very resistant to heat. It may take 6 hours or more at boiling temperature (212°) to kill these spores, but at

240°, the temperature obtained in the steam pressure canner, they may be destroyed in 30 minutes.

Whether foods are acid or nonacid also makes a difference in the rate at which bacteria may be killed. When the foods are definitely acid, as, for example, fruits and tomatoes, all forms of bacteria are killed within a reasonable time at the temperature of boiling water. With the nonacid foods, such as meats and corn, peas, beans, and practically all vegetables except tomatoes, these heat-resistant bacteria can be killed with speed and surety only at the high temperatures obtainable in the steam-pressure canner.

The types of bacteria vary with different foods, also with the year, the locality, and the conditions of production. For example, some of the most heat-resistant forms of bacteria are in the soil. Consequently a low-growing vegetable like spinach may be heavily contaminated and the fuzzy coating on string beans may shelter such bacteria and make them difficult to remove.

Bacteria may cause the following types of spoilage in canned foods:

Fermentation.—Acid and gas are produced by the action of bacteria during fermentation causing the food to become sour or "cheesy." Tin cans may bulge or seals on glass jars may be broken by the accumulated gas.

Flat sour.—The bacteria causing flat-sour spoilage produce acid without gas. They grow best at temperatures about 130° to 140° F. and sometimes cause spoilage in canned foods not properly cooled after processing or held at too-high storage temperatures. Corn, peas, and string beans are subject to flat-sour spoilage.

Putrefaction.—The growth of putrefactive bacteria in canned food is marked by gas production, a bad odor, and the softening and darkening of the food. Putrefaction usually occurs in foods low in acidity, such as meats, peas, and corn.

Botulinus spoilage.—When the spores of botulinus bacteria are not destroyed in the canning process they may grow later and produce a toxin in the food. Since a number of cases of botulinus poisoning have been traced to inadequately processed foods, the botulinus bacteria have been studied in order to find the temperature and conditions necessary for destroying them. They will not grow in salt solutions when more than 9 percent of salt is present. They are destroyed by processing at 212° F. if the solution is sufficiently acid. With beans, corn, peas, and other nonacid vegetables and meats they may not be killed at the temperature of boiling water (212° F.) unless the food is heated for 6 to 10 hours or even longer, but the time may be decreased very much if the higher temperature of the steam pressure canner is used.

Since various agents, such as birds and winds blowing dust, may carry bacteria from one area to another, it cannot be assumed that any particular locality is free from botulinus bacteria. The directions in this bulletin for handling the various fruits, vegetables, and meats have been prepared as a safeguard against spoilage due to this dangerous type of bacteria.

ACID AND NONACID FOODS DEFINED

For purposes of canning, foods are considered in two groups according to the quantity of free acid they contain. The acid foods are fruits, tomatoes, pickled beets, ripe pimientos, and rhubarb. The

nonacid foods include all other vegetables, such as asparagus, peas, beans, and corn, and also meats and poultry.

The acid foods are processed at or near the temperature of boiling water (212° F.) in a boiling-water bath, or in a steamer without pressure, or in an oven. The acid products may also be canned from the open kettle.

Nonacid foods must be processed in a steam pressure canner at temperatures of 240° to 250° F. obtained by applying 10 to 15 pounds of steam pressure.

The addition of small quantities of an acid, such as vinegar or lemon juice, to a nonacid vegetable or meat does not change the acidity of the food enough to permit processing in the boiling-water bath. This can be done only if enough acid is added to pickle the food. For example, beets are a nonacid vegetable and need to be processed under steam pressure, but when they are pickled in vinegar they may be handled as an acid product in the boiling-water bath.

The use of chemical preservatives, such as salicylic acid, sodium benzoate, and "canning powders", should be avoided in home-canning any kind of food. These chemicals vary in their effects on the human body, some being more harmful than others. Therefore the safe way for the home canner is to process foods adequately with heat and not to use chemical preservatives.

EQUIPMENT AND METHODS

Prepare for the canning season by checking over in advance the equipment and materials that will be needed. This may prevent delays when the food is ready to can.

THE BOILING-WATER BATH

For processing acid foods, the water bath is the most generally satisfactory method in the home. If water is boiled in an open vessel or in one on which the top is not clamped down tightly, the temperature reached is never higher than the boiling point of water. All additional heat applied goes to changing the water to steam, and the water boils away. Therefore the temperature of the food in the cans surrounded by the boiling water does not go higher than that of the water. Moreover, the boiling point of water is not always the same. It depends upon atmospheric pressure, which changes with the altitude. At sea level the boiling point of water is 212° F., and it decreases as the altitude increases. Allowance should be made for this in home canning.

In this bulletin the directions for processing in boiling water are based on the boiling point at altitudes of 1,000 feet or less. For altitudes above 1,000 feet the length of processing should be increased 20 percent for each additional 1,000 feet.

Altitude (feet)	*Temperature of boiling water* ° *F.*	° *C.*	*Altitude (feet)*	*Temperature of boiling water* ° *F.*	° *C.*
Sea level	212	100	5,225	202	94
1,025	210	99	6,304	200	93
2,063	208	98	7,381	198	92
3,115	206	97	8,481	196	91
4,169	204	95	9,031	195	90

A water-bath canner may be made from a wash boiler, a bucket, or any vessel that has a tight cover and is large enough to hold a convenient number of cans of food and to permit covering them with 1 to 2 inches of water. It should be fitted with a rack to hold the jars. A wire basket for this purpose can be made by a tinner at small cost or at home from wire-mesh fencing, or it may be purchased.

In processing fruits and other acid foods in the water bath, be sure that the jars or cans are far enough apart and that the rack on which they are supported is so arranged that the water can circulate freely under and around them.

Have the water in the canner boiling before putting in the cans of food. In order to keep the glass jars from breaking they must be preheated in water or filled with hot food.

When all the containers are in the canner, see that the water comes over the tops at least 1 or 2 inches. Add more boiling water as needed to keep this level.

Count time as soon as the water begins to boil vigorously. Keep the bath boiling constantly during all of the processing period.

As soon as the processing time is up, remove the glass jars from the water one at a time and seal tightly at once. Adjustments used for sealing the different kinds of jars are described on pages 9 and 10.

Tin cans are sealed before they are placed in the water-bath canner and need no further adjustment.

STEAMERS AND OVENS

In canning acid foods, heat may also be applied in a steamer or an oven.

In the steamer, where the steam circulates but is not held under pressure, the temperature surrounding the cans of food may be the same as in the boiling-water bath. It is necessary, however, to maintain a good circulation of steam if this method is to be efficient in processing. In actual practice, the steamer is often used without good circulation of steam and for that reason is unsatisfactory. When the steamer is properly operated, the processing periods for acid foods are the same as in the water bath.

Oven canning refers to the processing of food in glass jars in an oven. The temperatures generally used for the oven are from 250° to 275° F. Even with the oven at these or higher temperatures the food being processed inside the jars is little if any hotter than boiling water. For as steam forms in the jars it forces its way out, and the temperature remains near 212° F. The glass jars can be only partially sealed for oven processing; otherwise the accumulated steam would break the seals or the jars themselves. Tin cans cannot be used in oven canning because of the danger of spreading or bursting the seams.

Since the temperature of the food in oven canning is only about 212° F., this method is not safe for nonacid foods. Oven canning is used successfully for some acid products such as the small fruits. Peaches, pears, and apricots, especially when packed without precooking, are likely to develop a brownish discoloration after oven canning. Another disadvantage of oven canning is that some of the liquid bubbles out of the jars and is lost.

Processing periods in the oven are about half as long again as in the boiling-water bath because the air in the oven is not so good a

conductor of heat as is water. However, if the food is precooked and packed hot into the jars, the processing period in the oven may be shortened somewhat. Even so, it is still longer than that in the boiling-water bath. For example, peaches packed hot require 15 minutes processing in the water bath, but in the oven, 25 minutes.

THE OPEN KETTLE

In the so-called open-kettle method fruits or tomatoes are cooked directly in an open vessel to kill the bacteria. This cooking takes the place of both precooking and processing in the other methods. Water or sirup is added as required, and the food is boiled for several minutes, or until softened if it is firm fruit. It is then quickly filled into sterilized jars, and each one sealed immediately. The jars should be filled to the top to drive out the air.

In this open-kettle method though the food heats through evenly and quickly the temperature does not go above the boiling point of water, except as it may be slightly raised by added sugar or soluble materials in the juices. Therefore this method can be used only for fruits and tomatoes canned in glass. Disadvantages of the open-kettle method are the necessity for sterilizing jars and caps before using (p. 10) and the chance of contaminating them again during filling. Furthermore, there is always danger that air containing micro-organisms will be incorporated when jars are filled in this way. If they are sealed while boiling hot, however, this danger is in part avoided. Tin cans should not be used for open-kettle canning of fruits and tomatoes because the lids cannot be sterilized before sealing on the can (p. 15). This method cannot be used safely for canning nonacid foods.

THE STEAM PRESSURE CANNER

A steam pressure canner is required for processing meats, practically all vegetables except tomatoes, and other nonacid foods. Such foods should not be canned at home if a pressure canner is not available. Other methods of preservation should be used to make the products safe, such as drying, pickling, and storing for fruits and vegetables, and curing for meats.

The pressure canner is specially designed to obtain temperatures higher than can be reached in a boiling-water bath or an ordinary steamer. It is impossible to heat water to a temperature higher than the boiling point at the particular altitude at which the test is made, unless the vessel has a tight-fitting cover clamped down so that the steam is held in under pressure. Pressure canners, now manufactured in aluminum and steel, serve this purpose.

In selecting a pressure canner the following points should be carefully checked:

A pressure canner should be strongly built, and the top should be held on tightly by a number of lugs or clamps or a strong band so that there can be no leakage of steam. The top must be fitted with an air outlet or petcock, a safety valve (petcock and safety valve may be combined), and a pressure gage. It is desirable, also, to have a thermometer set into the top, so that the pressure can be checked against the temperature. Pressure canners of the usual household sizes are not manufactured with thermometers, but on canners of larger size, as 40-quart or more capacity, a reliable thermometer can

be inserted for a few dollars' additional cost. If nonacid foods are being canned for sale, the pressure canners should be equipped with thermometers to make certain that the processing will be adequate. Pressure gages may become inaccurate after a period of use. Those that have the indicator soldered or otherwise attached permanently to the stem will remain in good condition longer than gages in which the indicator is held in place by friction only.

The size of the pressure canner should be suitable to the kind of containers and the probable number to be handled at one time. For home use, pressure canners of from 18- to 30-quart capacity are satisfactory. The smaller steam pressure outfits, of 10- to 12-quart capacity, are intended for cooking rather than canning. They hold only a few cans at a time, and it is almost impossible to operate them so that the pressure does not fluctuate during the processing period. If home canning is to be done regularly therefore it pays to have a good-sized pressure canner in perfect working order (table 1).

TABLE 1.—*Approximate capacity of steam pressure canners of various sizes*

Size of canner (quarts)	Net weight of canner	Capacity			
		No. 2 tin cans	No. 3 tin cans	Pint glass jars	Quart glass jars
	Pounds	*Number*	*Number*	*Number*	*Number*
18	18	14	8	8	5
25	27	16	10	18	7
30	35	19	12	20	8
40	50	25	16	24	16

Since the temperature obtained in the steam pressure canner, as well as in the boiling-water bath, is affected by altitude, allowance for this must be made in home canning. In this bulletin processing periods are based on the pressure-temperature figures at sea level. At altitudes over 2,000 feet, add 1 pound pressure for each additional 2,000 feet (table 2).

TABLE 2.—*Pounds of steam pressure obtainable in canner and approximate corresponding degree of temperature, under standard conditions at sea level*

Steam pressure (pounds)	Temperature		Steam pressure (pounds)	Temperature	
	° *F.*	° *C.*		° *F.*	° *C.*
5	228	109	20	259	126
10	240	115	25	267	131
15	250	121			

In operating and caring for a pressure canner follow the directions of the manufacturer. Certain points need special attention.

Pour boiling water into the canner to a depth of about 1 inch or until the level is just below the rack that holds the containers. Add more water up to this level after processing each load, so that the canner will not boil dry and be damaged.

Allow space between the containers for the circulation of steam. Tin cans may be arranged in several tiers by using a wire rack or

metal strips to keep the cans apart and permit the circulation of steam.

After the canner is loaded, adjust the cover and fasten it securely. If there are several clamps fasten moderately tight those opposite each other, a pair at a time; then go back over the whole set and tighten each pair.

See that no steam escapes anywhere except at the petcock.

Allow the petcock to remain open until the steam escapes from it in a steady stream for 4 to 7 minutes, indicating that no air remains inside. Otherwise the pressure will be partly due to air, and the temperature will fall short of the required degree. Then close the petcock and allow the pressure to rise until the gage registers the desired point.

Count time from the moment the desired pressure is reached. Keep close watch on the canner while in use. Regulate the heat carefully so as to maintain a uniform pressure during the processing period, and do not allow drafts to blow on the canner. Fluctuations in pressure, as from 10 pounds to 15 pounds and down again, should always be avoided. This may cause loss of liquid from glass jars. It is especially important to keep the pressure from going so high that the safety valve releases the steam suddenly, nor should the steam be allowed to escape suddenly by opening the petcock.

At the end of the processing period remove the canner from the fire.

When using glass jars or no. 3 or larger tin cans, allow the canner to cool until the gage registers zero before opening the petcock, and then open gradually. Remove glass jars one at a time and seal tightly at once. Adjustments vary with the types of jar (p. 10). If liquid has been lost, do not open the jars to add more.

Do not hasten the cooling of a pressure canner by applying cold water or wet cloths, or by placing it on a cold surface. To do so may crack the canner.

If tin cans smaller than no. 3 are used, open the petcock gradually at the end of processing and allow the steam to escape slowly.

When opening the pressure canner, tilt the cover so that the steam emerges away from the operator.

Wash the pressure canner after it has been used. Keep the surfaces which form the closure between pot and cover clean. This will reduce the tendency of the cover to stick. Use care not to dent or roughen these surfaces. Do not use an abrasive on them. New pressure canners sometimes leak steam slightly at this junction, but after being heated several times the surfaces should adjust to each other to make the closure tight.

Keep the safety valve in good working condition. If it is a valve of the ball and socket type, wash it each day after using. A safety valve that fails to operate properly may cause an accident.

Use a toothpick to keep the opening of the pressure gage clean. Do not immerse the pressure gage in water.

Since pressure gages sometimes get out of order and fail to register correctly, it is essential to check them by comparison with a master pressure gage at the beginning of the canning season, or more often if the canner is in constant use. To make the test, use a pair of pliers to unscrew the petcock or safety valve from the lid of the pressure canner and replace it with the master gage. Then run the pressure up gradually while comparing the two gages. After the

test is over, reset the petcock or safety valve with a steamtight closure by applying a paste of litharge and glycerin, such as plumbers use, to the threads of the stem before screwing it into the lid.

Or the pressure canner lid may be sent back to the manufacturer to have the gage checked and repairs made.

GLASS JARS, RUBBER RINGS, AND BOTTLES

The containers most used for home canning are glass jars. If new rubbers are purchased, and in some cases new caps, the jars can be used repeatedly.

Types of jars.—The original mason jar has a porcelain-lined metal screw cap. The difficulty experienced by many in cleaning this cap has led to the development of modified forms that have glass or lacquered metal tops held in place by wire clamps or screw bands. The original mason jar is sealed by screwing the cap down tightly on a rubber ring placed between the cap and the lid. The edge of the cap must be even and free from dents to make a perfect seal. Prying the cap up with a knife blade will dent the edge and make the cap unfit to use again. If the porcelain lining becomes loosened or broken, the cap should be discarded. Otherwise the cap may be used repeatedly, but the rubber ring should be replaced each time.

In the lightning-type modified mason jar the cover is a glass disk that fits down onto a rubber ring and is held in place by a wire clamp. This kind of lid is very easily cleaned and sterilized, and if handled with care will last as long as the jar. The jar is easily sealed by pushing down the side clamp, and can be opened with little difficulty by raising this clamp and pulling out the rubber. If the wire clamp becomes loosened after use it can be tightened by removing the top wire, bending it down in the middle, and then bending the sides inward, if necessary, to fit the jar.

The automatic-, self-, or vacuum-sealing type of jar is sealed automatically when the jar cools, after being processed. The caps on these jars consist of lacquered metal or glass disks edged with a vegetable composition or a rubber ring which acts as a sealing gasket. The cap is held in place by a screw band or clamp. Caps of this type which have vegetable composition gaskets or permanently fixed rubber rings can be used only once, as it is necessary to have a cap with a new gasket each time the jar is used to obtain a perfect seal. With the caps that have separate rubber rings, only the ring needs to be replaced each time the jar is used.

Rubber rings.—Rubber rings are important to the successful use of glass jars. They must be bought new each year and should be of good quality if they are to withstand the temperature of processing. The simplest test is to double the ring together and press the fold with the fingers. The rubber should not crack under this treatment. A good rubber ring should also stretch to twice its length and return without change of shape.

Sizes of glass jars.—Glass jars are obtainable in half-pint, pint, quart, and half-gallon sizes. The half-pint is commonly used for fruit preserves, jams, or similar products. The pint and quart sizes are most used for canning purposes. Acid fruits and tomatoes are sometimes packed in half-gallon jars, but this size should not be used for nonacid vegetables and meats because of the slower heat penetration which makes longer processing necessary. Glass jars are made

in both round and square shapes, and with standard-width or extra-width mouths.

Preparing glass jars for use.—Examine glass jars and caps before using to make certain that they are in good condition. Discard any jars or caps showing cracks, chips, or dents, and any caps with loose linings. Tighten loose wire clamps on the jars.

Wash the jars, also zinc and glass caps, in soapy water and rinse. Place them in a pan of warm water with a rack or cloth in the bottom to prevent bumping. Bring to the boiling point and keep hot until required. Jars for open kettle canning should be sterilized by 15 to 20 minutes boiling. When jars are packed with food and then processed they do not need to be sterilized first, but they should be clean and hot when filled. Prepare jar caps that have a sealing composition by pouring boiling water over them and allow them to stand until used. Dip rubber rings into boiling water before adjusting on the jars.

Head space.—When food is processed in glass jars a head space is left at the top to permit expansion of the food. Head space is measured from a straight edge laid across the top of the jar. Allow one-half inch of head space in all jars except those containing starchy foods (corn, peas, and lima beans); they require 1 inch because of greater expansion. The solid material in jars should be covered by liquid—water, sirup, or broth, as the case may be.

Exhausting and cooling glass jars.—All types of glass jars can be adjusted to allow the exhausting, or passing out, of air from the food during processing.

With the mason jar the cap is screwed on until it is tight and then turned back one-fourth inch. After processing the cap is screwed down as tightly as possible on the jar. With the "lightning-type" modified mason the top clamp is snapped into place and the side clamp is left up. After processing the side clamp is pushed down. In both of these jars the actual seal is formed by the pull of the partial vacuum in the jar during cooling. Hence, it is better if these jars are cooled in an upright position.

With the vacuum- or self-sealing jars no special adjustment is used for exhausting the air. The screw bands are put on tight or the clamps adjusted. During the processing period the top is held in place by the band or clamp, which allows the air to escape but holds the top to the jar. When the jar starts to cool after processing, the steam condenses and a partial vacuum is formed within. Greater pressure outside the jar than inside presses the top down firmly and the seal is formed between top, gasket, and jar. The sealing material hardens as the jar cools, making the seal complete. If the screw band is loose after processing, hold the lid in place so it will not turn, and screw the band tight. Jars of this type must be left to cool in an upright position. When the jars have cooled, remove the screw bands and clamps and save them to use again.

Cool all glass jars in air out of drafts. Special care should be taken to protect jars that have just been taken from a pressure canner, as the temperature of the food is still above the boiling point. This places the glass under considerable strain and breakage may occur if a draft strikes the jars. Leaving the jars in the canner for 3 or 4 minutes after the canner has been opened will reduce the danger of

breakage. Use a jar lifter or tongs to remove the jars from the pressure canner.

Do not cover the jars with cloths or blankets while cooling as this prolongs the cooking of the food and may result in flat-sour spoilage. The processing period is adequate to make the food keep, and cooling should follow at once.

After processing and cooling, all types of glass jars should be inverted and observed for leakage.

Loss of liquid from glass jars during processing.—When glass jars are processed in the steam pressure canner there is frequently a loss of liquid. While this may occur to some extent with all types of jars, it is generally less with those of the vacuum-sealing type which have a separate rubber ring or sealing composition in addition to the glass or metal cap and screw band. Mason and lightning-type mason jars are partially sealed before they are put in the canner, and the seals are completed as soon as they are taken out. Tight sealing of these jars will not prevent the loss of liquid during pressure processing and may cause the rubbers to push out, thus making a tight seal difficult to obtain. For adjustments of the different types of jars see page 10. Steps can be taken to reduce the loss of liquid by properly regulating the pressure canner (p. 8).

During water-bath processing the water should cover the jars at least 1 to 2 inches and should be kept boiling constantly.

In no case, open the jars after processing to add more liquid.

Removing jar caps.—To remove caps from the self- or automatic-sealing jars, puncture the caps to release the vacuum and lift up. For other types of jars pull out the rubber ring with the fingers or with pliers. If this is difficult, invert the jar in warm water covering the cap and allow the jar to remain for several minutes. This will soften the rubber ring and make it easier to remove.

Bottles.—Bottles are convenient to use for canning liquids. Use the crown caps and a capping device, which may be obtained at small cost. Bottles should be boiled to sterilize them, but the caps are only dipped in boiling water just before being fixed on the bottles. Boiling the caps may prevent the formation of tight seals.

When liquids are processed in bottles it is necessary to leave about 2 inches of head space to permit expansion.

TIN CANS AND SEALING MACHINES

Where large quantities of food are canned at home, tin containers have certain points in their favor. Tin cans are easy to handle because there is no danger of breakage. Also, there is no loss of liquid from tin cans because they are always tightly sealed before they are processed. They are economical of space in the canner, and several tiers may be packed in and processed at one time. The processing period is shorter than with glass jars because heat penetrates tin more quickly than glass. Furthermore, tin cans may be plunged into cold water as soon as they are taken from the canner, and this rapid cooling prevents some products from becoming overcooked.

Plain tin and enameled cans.—Plain tin cans are made of thin sheet steel plated with tin. These cans are satisfactory for most vegetables, fruits, and meats. Some foods, however, change color when canned in plain tin because of chemical reactions due to the

metals. These changes do not affect the wholesomeness of the food, but they do affect the appearance. Red-colored fruits and vegetables, including most berries, cherries, currants, plums, and beets, which owe their color to anthocyanin pigments, fade when they are heated in contact with plain tin. Corn becomes darkened in color when canned in plain tin. The high temperatures necessary in processing corn cause hydrogen sulphide gas to be liberated, and this reacts with the metals of the can and forms dark-colored metallic sulphides that are deposited on the corn and on the can. Succotash and lima beans behave in a similar manner, but to a lesser extent. With peas, some meats, and other foods the metallic sulphides may merely cause the can to mottle or darken.

Enameled-lined cans have come into use to preserve the appearance of foods that discolor in plain tin, or to prevent excessive darkening or corrosion of the cans. Sanitary, fruit, or R enamel, of a deep-gold color with a bright finish, is used to keep red-colored fruits and beets from fading, and pumpkin and squash from corroding the can. C or corn enamel, of light-gold color with dull finish, is used to prevent corn, succotash, and some other products from discoloring. C enamel should not be used with acid foods or with chicken or meats that contain much fat. The acid or fat may cause this enamel to peel off and make the food unsightly, although harmless.

The following list gives the kind of enameled can recommended for different foods; other foods may be satisfactorily canned in plain tin:

C enamel	*Sanitary enamel*
Beans, lima (C enamel preferred; plain tin also used).	Beets (sanitary enamel preferred; C enamel also used. For pickled beets, use glass only).
Beans, Red Kidney (C enamel preferred; plain tin also used).	Berries, all kinds.
Corn.	Cherries.
Succotash.	Cranberry sauce.
	Pimientos.
	Plums.
	Pumpkin.
	Squash.

Gaskets.—Under the rim of the can lid is a gasket of paper or rubber composition, which helps to make the seal airtight. The sealing machine folds this into a double seam between the can and lid. Whether a paper or rubber composition gasket is preferable depends on the machine and the care with which it is operated (p. 14). The paper gasket is generally recommended in home canning, because it is a little more bulky and more completely fills the seam made by hand-sealing machines. When the better grade of hand-sealing machines and power machines are used by experienced operators the rubber gasket is preferred. Paper gaskets also make a better seal when reflanged cans are used. Some disadvantages of the paper gaskets are that they must be kept dry; they sometimes drop out of the cover; and they may wrinkle if wet or imperfectly adjusted, and thus cause a faulty seal.

Sizes of tin cans.—The usual sizes of cans for home use are no. 2, no. 2½, and no. 3. The larger sizes, no. 5 (half-gallon), and no. 10 (gallon), are generally for hotel and institution use. When no. 5 and no. 10 cans are processed under pressure special precautions must be taken to prevent the cans from buckling. Various practical points about the use of the different-sized cans are given in table 3.

TABLE 3.—*Capacity and use of standard sizes of tin cans*

Can size	Dimensions	Contents, average net weight	Volume of contents	Products adapted to different-sized cans
	Inches	*Ounces*	*Cups*	
No. 1, tall	3 1/16 by 4 11/16	16	2	Concentrated soups, meat products.
No. 2	3 7/16 by 4 9/16	20	2½	Corn, peas, snap beans, fruits, meats.
No. 2½	4 1/16 by 4 11/16	28	3½	Fruits, vegetables, meats.
No. 3	4 4/16 by 4 13/16	33	4	Fruits, pumpkin, tomatoes.

Preparing tin cans for use.—Wash tin cans with soap and water, rinse in clear water, and drain. Lids may be wiped with a damp cloth, but gaskets, especially paper gaskets, should be kept dry to avoid difficulties in sealing.

Filling cans.—Fill cans to obtain a reasonably tight pack of solid food without cramming and add liquid to cover—water, sirup, or broth. The desirable proportion of liquid to solids varies with different products. Uniformity of pack may be obtained by weighing the solids and adding enough liquid to cover, or by weighing both solids and liquid. Packing by weight may be desirable for large-quantity canning, as in a community center, or for products intended for sale.

The liquid in the can serves two important purposes. It helps to drive out air from the can, and also to conduct heat into the solid material during processing. Foods packed without liquid require a heavier processing because of the slower penetration of the heat into the food.

Head space.—Head space is needed to prevent the cans from bulging, because of the expansion of the food during processing and storage. If a can is filled too full, it does not have sufficient head space and cannot be properly sealed; whereas too slack a fill, or excessive head space, leaves too much air in the can. Head space is measured from a straight edge across the top of the can. Since the cover goes one-eighth inch into the can, the actual head space is less after the cover is sealed on. For most foods canned at home or in community centers, the following allowances are recommended, although head space varies somewhat for different products:

	Head space (inch)
No. 1 cans	¼
No. 2 cans	5/16
No. 3 cans	⅜ to ½

Exhausting or precooking.—All fresh foods contain air within their tissues. In canning in tin unless most of this air is removed by some means before the cans are sealed, both the food and the can discolor, and the food loses flavor.

With fruits, tomatoes, asparagus, and meats the air is often exhausted in the following way. After the raw food is packed in the cans, place them in a bath of boiling water deep enough to come within about 2 inches of the top of the cans. Regulate the heat so as to keep the water boiling without bubbling into the food and cover the bath to hold in the steam. Start counting time when the space

above the cans is filled with steam, and continue to heat for the time given for the various foods. Seal the cans as rapidly as possible after the exhaust, while the food is still steaming, and process at once. This method is not suitable for glass jars because of the slower penetration of heat.

The nonacid vegetables, such as beans, peas, corn, and pumpkin, are precooked to drive the air out of the tissues. They are then packed boiling hot, and the tin cans are sealed at once and processed.

Sealing temperature.—The food must be hot when the cans are sealed in order to insure a satisfactory vacuum. It is a good practice to measure this sealing temperature at the center of the can with a thermometer. For tomatoes, fruits, and other foods that heat penetrates easily, the sealing temperature should be about 125° to 150° F. But for other products, such as cream-style corn, pumpkin, and squash, through which heat penetrates slowly, sealing temperatures should be 180° to 190°. For meats, about 170° is recommended.

Cooling.—After processing tin cans up to and including the no. 2½ size, open the petcock on the pressure canner to let the steam escape gradually, as the pressure drops to zero. With no. 3 cans and larger sizes, allow the pressure gage to come to zero; then open the petcock gradually.

Cool tin cans at once in cold water, preferably running water, until they are lukewarm, or about 100° to 105° F. If the cans have paper gaskets, use only water suitable for drinking, so as to avoid contamination. When the cans are cool, wipe off any remaining moisture, and examine for leaky seals.

Sealing machines.—A machine is necessary for sealing open-top cans. Sealing machines must be strongly built to be durable and efficient. It is poor economy to purchase a machine too light in construction to do its work well; such a machine is likely to break and to be difficult to keep in proper adjustment for sealing the cans tightly. For home canning a hand-operated machine is satisfactory, but for continual use, as in a community canning center, power operation may be desired.

Different makes of sealing machines vary in design, and the manufacturer's instructions regarding the care and operation of the machine should be followed. With all types, however, the actual seaming process of the cans is the same. The filled can with cover is set on the base plate and is raised by a lever until the chuck of the machine fits closely into a countersink about one-eighth inch deep in the top of the can lid. The can is rotated while the first seaming roll of the machine folds the flange of the cover over the flange of the can. The second seaming roll of the machine then presses the folded layers together into a tight seam which is made airtight by the gasket of the lid. The seaming rolls should be observed frequently to see that they are in proper adjustment. Some machines are furnished with a wire or other means of testing the adjustment of the seaming rolls.

Tests for tight seals.—The finished seam between lid and can should be smooth and even. A way to try out the adjustment of the sealer is to test the tightness of the seam on a can. Place a few tablespoons of water in a can, seal it, then submerge it in boiling water for a few minutes. If air bubbles come up from the can, the seam is not tight.

Reflanging cans.—Tin cans are sometimes reflanged for use a second time by means of special attachments on the sealing machine both for opening the cans and for reflanging. Cans that are corroded or very much discolored should never be used a second time. Also unless the reflanging is properly done and the sealing machine is adjusted to handle reflanged cans, it is impossible to obtain a tight closure. The use of reflanged cans, therefore, is not generally recommended.

UTENSILS

Most of the utensils needed for home canning are in common use in the kitchen. In addition to the containers and processing equipment and a worktable and sink, the following utensils are generally needed:

Shallow pans.
Preserving kettles.
Colander.
Wire basket or cheesecloth.
Jar funnel.
Quart measure.
Standard measuring cup.
Ladle or dipper.
Jar tongs.
Long-handled spoons.
Stainless-steel paring knives.
Cutting knife.
Scissors.
Household scales.
Vegetable brush.
Thermometer.

Special devices may be provided if desired for paring apples and peaches; coring apples, pears, and tomatoes; pitting peaches and cherries; shelling peas; and slicing, cubing, grinding, and sieving food materials.

The thermometer should be of the type that can be immersed in liquids, and should register at least to 220° F. A candy or dairy thermometer may be used, and can usually be obtained through local dealers for about a dollar.

When fruits are being canned for sale a sugar tester or saccharometer is very useful to measure the concentration of sugar in the sirups. The Brix and Balling saccharometers or hydrometers (p. 19) indicate directly the percentage of sugar in the solution. The Baumé saccharometer differs in the scale and does not indicate the percentage of sugar directly. The approximate percentage is obtained by multiplying the reading by 2. A saccharometer costs about 75 cents.

Utensils for cooking foods for canning may be of aluminum or a good grade of enamelware or stainless steel. Do not use galvanized-iron utensils for cooking any food or for holding acid foods with cut surfaces, as the foods will take up zinc and become poisonous. Copper or copper-lined utensils may be used for cooking fruits and vegetables, provided the utensils are kept bright and shiny so that no copper salts accumulate and provided the food is removed from the utensils at once after cooking.

WATER

The water used for various purposes in canning, such as washing food and utensils, cooking, making sirups, and cooling cans, should be suitable for drinking. Very hard water may toughen vegetable tissues or make fruit sirups cloudy. Such water can be partially softened by boiling and straining through several thicknesses of muslin. Or the boiled water may be allowed to stand until the fine precipitate settles, and the clear water poured off for use.

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STEPS IN CANNING

Safe canning requires careful attention to every step in the process from the selection of the raw food to the final check-up of the canned products during storage. The following list gives the steps in order:

1. Select good materials. The quality of canned products can be no higher than the quality of the raw food that goes into the can. Use only clean, fresh, sound foods in prime condition, and be sure that the containers in which they are handled are clean. Any unnecessary infection of the raw food increases the difficulty of processing and the liability of spoilage of the canned products.

With fruits and vegetables, grade for size and the same degree of ripeness if a uniform product is desired. Wash thoroughly until every trace of soil is removed. The most dangerous bacteria and those most difficult to kill are in the soil. A wire basket is a help in washing, but should not be loaded too heavily. Always lift the fruit and vegetables out of the water rather than pour the water off.

For special precautions about meats, see page 31.

2. Prepare jars or cans. Follow the directions for glass jars on page 9 and those for tin cans on page 11.

3. Sirup. Make the sirup for fruits in advance so there will be no delay when it is required (p. 19).

4. Precooking. Some foods are precooked for a short time before they are packed into the containers. This precook helps to remove air from the tissues, shrinks them, facilitates packing, and speeds up the processing because the foods are already hot when they are placed in the canner.

5. Packing. When using glass jars, remove one jar at a time from the hot-water bath where it has been held. Keeping the jars hot helps to prevent breakage during packing and processing. If needed, place a new wet rubber ring in position resting flat on the sealing shoulder of the jar.

Pack the containers quickly so that the precooked food remains hot. Use a sufficient proportion of liquid to solids to prevent too dense a pack, and work out the air bubbles with a knife blade or spatula.

Leave the proper headspace in the containers (pp. 10 and 13).

6. Exhausting and adjusting covers. Food in glass jars is exhausted, or the air partially removed during processing, because the jars are not fully sealed. As each glass jar is packed, carefully wipe off the rubber ring to remove any particles of food, and adjust the cap to seal the jar partially and permit exhausting (p. 10). Place the jars as finished in the canner or where they will keep hot until processing begins.

Tin cans packed with precooked food should be sealed at once, while the food is steaming hot, and placed in the canner. If the food has not been precooked before packing, it should be exhausted (p. 13). Seal the cans at once after exhausting.

7. Processing. Process at the temperature and for the time indicated in the tables on pages 24, 25, 28, 29, and 37.

8. Cooling. Cool glass jars in air but protect them from drafts. After they are cool, invert, and observe for leakage. Do not attempt to tighten screw caps or screw bands after the jars have cooled.

Cool tin cans in cold water, using running water if possible.

9. Reprocessing. If any containers show signs of leakage, they should be opened, the contents heated and repacked in other containers, and processed again as at first.

10. Labeling. Wipe the containers clean and label with the name, the date, and the lot number, if more than one lot was canned on that day. Glass jars may be labeled with a pencil that writes on glass, or with gummed labels. Use rubber cement to fix paper labels on tin, or if the labels are long enough, put glue along one end, wrap smoothly around the can, and lap the glued end over the other. Or tin cans may be marked with a glass pencil, rubber stamp, or canners' ink.

11. Checking up results. Hold canned products at room temperature for a week or 10 days where they can be examined from time to time to be sure that they are keeping. If any show signs of spoilage, examine all of that lot carefully.

12. Storage. Store canned foods in a cool, dry place, and protect glass jars from the light so that the food will not fade in color. Canned foods if properly processed will keep almost indefinitely under the right conditions. However, the quality is generally better if they are used within the first year after canning.

EXAMINATION OF CANNED FOODS BEFORE USE

All foods should be inspected before being prepared for the table. Canned food is no exception to this rule. If there is any evidence of spoilage, the food should be discarded and nonacid vegetables and meats should be burned.

Inspect the can or jar before opening. In tin cans both ends should be flat and curved slightly inward. Neither end should bulge or snap back when pressed. All seams should be tight and clean, with no traces of leaks. In glass jars there should be no bulging of the rubber and no signs of leakage.

When the container is opened there should not be any sudden outburst of air or spurting of liquid. The odor should be characteristic of the product. Any different odor probably indicates spoilage. The inside of tin cans should be smooth and clean or well lacquered and not markedly corroded. Food may be left in a tin can after it is opened, provided it is covered and kept cold just as any other cooked food. Acid foods and tomatoes may dissolve minute quantities of iron from the can and acquire a slightly metallic flavor, but this is harmless. The purple that develops in red fruits and sometimes in peaches and pears canned in tin, is merely a change in the color pigments and is also harmless.

The broth over canned meats and chicken may or may not be jellied, depending on the quantity of connective tissue and cartilage in the meat. If it is liquid, this is no indication of spoilage.

Never taste to discover spoilage. When spoilage has occurred in nonacid foods there is always a possibility that even a taste may cause serious illness. For this reason it is good practice to boil all canned nonacid vegetables before using them. The processes recommended for meats are much heavier than for vegetables and should destroy all dangerous bacteria.

EVIDENCES OF SPOILAGE

Foods canned in tin sometimes show the following evidences of spoilage:

Buckled cans.—Cans that have caved in, or collapsed, on the sides are called buckled cans. This may occur when no. 3 or larger-sized cans are cooled too quickly after processing. These large cans should be allowed to remain in the canner until the pressure gage has reached zero to avoid too sudden change of pressure. Cans of smaller sizes when slack-filled sometimes buckle on cooling and break the seams. In this case the food should be put into other cans and reprocessed, or used at once.

Springers.—Springers are cans with bulged ends. The ends of cans generally become convex, or outwardly curved, during processing because of expansion of the food and the formation of steam. When the cans cool the ends should snap back to a concave, or inwardly curved position. If a can is too full, the ends may not snap back into proper position, and the can is called a springer. Such cans should be marked so they will not be confused with those that become bulged during storage.

Swelled cans.—When gas is formed within a can it may cause the ends of the can to bulge. For example, some fruits, such as prunes, apples, and some berries, react with the metals of the can, and hydrogen gas is liberated. When this collects the can may become a "hydrogen swell." In this case the food itself is not affected. However, in several types of food spoilage, gases are produced that cause swelled cans. For this reason bulged ends on a can are regarded as an indication of spoilage. When canned fruits show such a condition, they should be examined for other indications of spoilage. When a can of meat or nonacid vegetables has bulged ends it should be disposed of by burning.

Perforations.—Some of the fruits that react with the metals of the can producing hydrogen swells may also cause perforations and leaks. This results from the centering of the chemical reaction on a few points. If the can is discovered soon after leaking starts the food may be used, but if the leakage is not detected until later, fermentation or other types of spoilage may have set in.

Canned foods are likely to develop perforations and hydrogen swells rather quickly if stored in too warm a place; hence cool storage is especially important for canned fruits that react in this way on the metal.

FROZEN CANNED FOODS

Freezing does not cause canned foods to spoil unless it breaks the seal and permits micro-organisms to enter. All frozen canned foods should therefore be examined for leakage. Sometimes freezing may bulge tin cans and spread the seams enough to permit bacteria to enter and yet not cause leakage. Bulged cans of frozen food, therefore, should be used as promptly as possible if they cannot be kept frozen.

CANNING FRUITS, TOMATOES, AND OTHER ACID FOODS

Fruits, tomatoes, and other acid foods are best processed at 212° F., the temperature of boiling water at sea level. Read carefully the sections under methods and equipment that relate to the handling

of acid foods. The boiling-water bath is the most successful way of applying heat for processing foods of this type in the home.

The following figures are a rough guide to quantities of raw fruits needed to yield 1 quart or one no. 3 can of the canned product.

Fruit	*Quantity raw, as gathered, pounds*
Apples	2½
Berries	1¼ to 1½
Cherries	1¼ to 1½
Peaches	2 to 2½
Pears	2 to 2½
Plums	1½ to 2
Tomatoes	2½ to 3½

SIRUPS

Sirup made with granulated sugar is generally the most desirable sweetening for canned fruits. Cane sugar and beet sugar are equally good. Honey or light-colored sirups are sometimes substituted for part or all of the granulated sugar on the basis of measure for measure, but the results are variable. Brown sugar may carry spoilage bacteria or other impurities and is not recommended for use in canning.

It is advisable to prepare the sirup in advance of the time when it will be needed. For home canning the standard proportions are shown in table 4.

TABLE 4. *Proportions of sugar and water for light, medium, and heavy sirups*

Sirup	Sugar to 1 gallon of water				Degrees Balling or percent of sugar
	Cups	*Quarts*	*Pounds*	*Ounces*	
Light	5	1¼	2	2	20
Moderately light	8	2	3	10	30
Medium	12½	3⅛	5	9	40
Moderately heavy	19	4¾	8	6	50
Heavy	28	7	12	8	60

In making the sirup, add the sugar to the water, and dissolve by warming and stirring. Fill a tall cylinder with the sirup at 60° F. and place the saccharometer in it. The reading is taken at the surface of the liquid. The Balling or Brix saccharometers read directly in terms of percentage of sugar. A heavy sirup may be prepared and diluted with water to yield lighter sirups as required.

Sirups should be boiled, strained, and poured over the fruit boiling hot.

CANNING FRUITS WITHOUT SUGAR

Sugar may be added or not as desired in the canning of fruits. The shape, color, and flavor of the fruits are retained better when some sugar is added. Fruits for pie making or for use in diabetic diets are commonly canned without sugar. Juicy fruits, such as berries, cherries, currants, and plums, should be canned in their own juices when sugar is omitted. Water is not required. Extract the juice from the riper fruits by crushing, heating, and straining. Pack the remaining fruits closely into containers without preheating, and add boiling hot juice to cover. Partially seal glass jars; or exhaust tin

cans and seal; then process. Or give the fruits a short precooking, as 2 to 4 minutes simmering, pour into containers at once, seal, and process.

The less juicy fruits, such as apples, peaches, and pears, when canned without sugar require the addition of water. To preserve the natural fruit flavor use only the smallest quantity of water necessary. Follow the directions for canning given on pages 20 to 23, substituting water in place of the sirup.

DIRECTIONS FOR PACKING AND PROCESSING

Apples.—Apples packed raw shrink in canning, so that the containers are not full. This is prevented by precooking before packing. Pare the apples and cut into the sizes desired. If the pieces must stand, to prevent darkening place them in a mild salt and vinegar solution (2 tablespoons salt and 2 tablespoons vinegar per gallon of water). Precook by boiling 5 minutes in a light sirup, or steam until wilted. Fill into the cans hot and cover with boiling sirup. Pie apples are commonly packed in water or given a solid pack without added liquid.

Apples may be baked, as for serving, adding sugar to taste and water if necessary; or they may be boiled whole in sirup. Pack hot in the containers and cover with hot sirup.

Windfall or green apples may be made into sauce. Pack boiling hot.

Process as directed in table 5.

Apricots.—Same as peaches.

Beets, pickled.—Select beets of uniform size, cut off the tops, but allow at least 1 inch of the stems to remain so that the beets will not bleed and lose color and sweetness. Wash and cook until tender in enough water to cover. For young beets this will require about one-half hour. When tender plunge into cold water, remove the skins, and when cool cut in dice or thin slices. Pack into jars, to each pint add one-half teaspoon of salt, and fill with a mixture of vinegar and sugar in equal proportions by measure, heated to boiling, so that the sugar is thoroughly dissolved. If this is too acid, dilute the vinegar one-fourth with water. Process immediately as directed in table 5.

Berries: Blackberries, blueberries, dewberries, huckleberries, Logan blackberries, raspberries.—Gather berries in shallow vessels so as to prevent crushing, and can them as soon as possible. Wash carefully and remove caps and stems. Sort out the smaller and imperfect berries and extract juice from them for making a sirup of medium sweetness.

Raspberries and other berries of soft texture keep their shape better for dessert purposes if packed raw, although they tend to rise to the top of the container after processing. Press the raw fruit gently into the containers so they will be well filled, and cover with hot medium sirup. If using tin cans, exhaust for 3 to 5 minutes before sealing.

For use in pies and where the appearance of the whole fruit is not so important, precook the berries and pack hot. To each pound of raw berries add one-fourth to one-half pound of sugar, according to the sweetness of the fruit, stir gently, and boil for 3 to 4 minutes. Pack boiling hot.

Process as directed in table 5.

Cherries.—Cherries may be canned pitted or unpitted, depending upon the way in which they are to be served. If unpitted, prick them to prevent shrinkage, and save the juice to use in making the sirup. Pack the cherries in hot containers and cover with hot sirup—heavy sirup for sour cherries and medium for sweet. If using tin cans, exhaust for 3 to 5 minutes before sealing.

If cherries are pitted, boil them for 5 minutes with sugar to taste, and fill into the containers boiling hot.

Process as directed in table 5.

Currants.—Same as berries.

Gooseberries.—Use the method suggested for berries packed raw, substituting heavy for medium sirup. If using tin cans exhaust for 3 to 5 minutes before sealing.

Or add a small quantity of water to the gooseberries after they have been sorted and washed, and boil until they are cooked to a pulp. To each quart of this pulp add one-half cup of sugar or more if preferred. Heat until the sugar is dissolved, and pack boiling hot into containers.

Process as directed in table 5.

Peaches.—To prepare peaches for canning, immerse them in boiling water for about one-half minute or until the skins will slip easily, plunge at once into cold water for a few seconds, remove the skins, cut the peaches into halves, and discard the pits.

If a bushel or more of peaches or apricots is to be canned at one time, the skins may be removed in a lye bath. This method is not justified with a small quantity, unless the peaches are so firm that hot water will not loosen the skins. Be careful in using lye, especially if children are around, for it is a powerful caustic and serious accidents have happened.

To peel peaches or apricots with lye, prepare in an agateware or iron kettle (never aluminum) a solution of one-fourth pound (4 ounces or about 4 level tablespoons) of granulated lye of a standard brand in 2 gallons of water. Heat to boiling, and while the solution is actively boiling, immerse the peaches or apricots in it in a wire basket until the skin is loosened and partially dissolved. This will usually require 30 to 60 seconds. Remove the fruit, wash it at once in running water, if possible, until skin and lye are removed, and then thoroughly rinse the fruit. If the lye is not thoroughly rinsed off, the peaches may turn brown as a result. A 2-minute dip in a bath with 2 tablespoons each of salt and vinegar to each gallon of water also helps to prevent the fruit from browning. Lye-peeled fruit should be canned immediately.

If a thermometer is available it is better to use a stronger lye solution at a lower temperature. An 8 to 10 percent solution containing 1 pound of lye to 1½ gallons of water heated to 135° to 140° F. (not higher) is recommended.

Use light or medium sirup on peaches, as desired. In making it put in one cracked peach pit for every quart of sirup and strain out before using.

Peaches may be packed raw, but a better pack is obtained if the fruit is first simmered in the sirup for 4 to 8 minutes. Do not cook until soft. Pack at once, placing the halves pit side down in overlapping layers. Fill the containers with hot sirup. If the peaches

are packed cold in tin cans cover with hot sirup and exhaust the cans for 5 minutes before sealing. Process as directed in table 5.

Pears.—The quality of Kieffer pears is improved by holding the fruit for 2 weeks after harvest at a temperature of 60° to 65°F. before canning. Peel, cut in halves, and core. To prevent discoloration place the pared fruit in a solution made in the proportion of 2 tablespoons each of salt and vinegar to a gallon of water. Cook in boiling medium sirup for 4 to 8 minutes, according to the size and firmness of the fruit. Pack the pears hot into containers and fill with boiling sirup. If packed cold in tin cans, cover with hot sirup and exhaust for 5 minutes before sealing. Process immediately as directed in table 5.

Pimientos, ripe.—Select ripe, thick-fleshed pimientos, free from bruises. To remove the skin, immerse the whole peppers in hot cooking oil (290° F.) for 2 or 3 minutes, or place them in a hot oven (450°) for 6 to 8 minutes; then dip quickly into cold water. Slip the skins off, remove stems and seed cores. The peppers are then soft and pliable. Fold and pack them into the containers, and add one-half teaspoonful of salt to each pint. Add no liquid because the processing brings out almost enough thick liquor to cover them in the can. If using tin cans exhaust them for 5 minutes before sealing. Process immediately, as directed in table 5.

Pineapples.—Peel, core, and remove the "eyes." Slice crosswise, pack into the containers, and fill with boiling light sirup. Exhaust the tin cans for 5 minutes before sealing. Process immediately, as directed in table 5.

Plums.—Plums are ordinarily canned whole, and they should be gathered just as they are commencing to ripen. After they are washed, prick each plum to prevent the skin from bursting. Pack into containers and cover with hot medium sirup. Exhaust tin cans 5 minutes before sealing.

Or, if preferred, prepare sauce by cooking the plums with sugar to taste, and, if desired, strain out the pits and skins. Fill into the containers boiling hot. Process as directed in table 5.

Rhubarb.—Select young, tender stalks; trim, wash, and cut into half-inch lengths. Boil until soft in heavy sirup. Or add one-fourth as much sugar as rhubarb by measure, and bake until tender in a covered dish. Since rhubarb corrodes tin cans, it is better for home use to pack it in glass. Pack boiling hot into the jars and process immediately, as directed in table 5.

Sauerkraut.—Sauerkraut should be well fermented before it is canned. Heat the sauerkraut to simmering (about 180° F.), but avoid boiling. Fill hot into the containers and pack closely. Cover with the hot sauerkraut juice, leaving ⅛- to ¼-inch head space. Process immediately, as directed in table 5.

Strawberries.—Strawberries are usually more palatable when preserved than canned. In canning this method gives the best results: To each quart of washed and stemmed berries add 1 cup of sugar. Bring slowly to the boiling point and let stand overnight in the kettle. In the morning bring quickly to boiling, and fill into the containers. Process immediately, as directed in table 5.

Tomatoes.—Select firm, ripe tomatoes of medium size and uniform shape, free from spots and decay. Put into trays or shallow layers in wire baskets and dip in boiling water for about a minute, according to

ripeness. Then plunge quickly into cold water, drain, peel, and core promptly. Pack into the containers as closely as possible. Fill with tomato juice and add 1 teaspoon of salt per quart. If using tin cans, exhaust them 5 to 6 minutes before sealing.

Or cut the tomatoes in quarters, heat just to boiling, and pack hot. Process as directed in table 5.

Tomato juice.—To preserve the natural flavor and color in canned tomato juice, use knives of stainless steel and avoid utensils of copper, brass, and iron. Use only fully ripe, firm tomatoes, preferably of bright-red color, as freshly picked from the vines as possible. Discard any with green, moldy, or decayed portions. Wash well, remove cores, and cut into small pieces. The skins may or may not be removed. Handle the tomatoes in quantities of 1 to 2 gallons and avoid delay at any stage of the procedure. Precook the tomatoes at about 170° F. to 180° F., or if a thermometer is not available simmer until softened. Avoid boiling. Put the softened, hot tomatoes at once through a fine sieve, preferably a bowl- or cone-shaped sieve because it allows the least air to be incorporated in the pulp. If the tomato juice is for infant or invalid use, omit salt; otherwise add one-half to 1 teaspoon salt to each quart. Spices tend to darken the color of tomato juice and change the flavor undesirably; hence it is better to add them at the time of serving.

Reheat the juice at once after putting through the sieve. If using glass containers, heat the juice to 190° F. (or just to boiling), pour into the sterilized containers, and seal. No processing is necessary. Invert the bottles while cooling. If tin cans are used, heat the juice 180° to 190° (or to simmering if no thermometer is available), pour into cans, seal, and process the cans as directed in table 5. Do not leave head space in either glass or tin containers.

Fruit juices for beverages from berries, cherries, currants, and plums.—Use only sound, well-ripened fruit in such quantities that the process can be carried through promptly. To avoid overcooking and to preserve as much as possible of the original flavor and color, check the temperature with a thermometer as the fruit is precooked and the juice pasteurized. Sugar also helps to preserve color and flavor, but it may be omitted if an unsweetened juice is preferred.

Wash the fruit, drain, and crush. Add water, if desired, to thin the juice—about ½ cup of water to each pound of fruit. Heat to 170° to 180° F., and hold for several minutes, or until the juice can be separated from the pulp. Extract the juice with a fruit press or strain through several layers of cheesecloth. A second straining without pressure makes the juice clearer. Add sugar if desired, about ½ to 1 cup of sugar to a gallon of juice. Heat the juice to 160° to 170° and fill into hot, sterilized glass jars or bottles to within ⅛ inch of the top. Seal at once, and lay bottles on their sides in the water bath. Process immediately, as directed in table 5.

Fruit purees.—For purees of almost any soft fruit put the cooked fruit through a fine sieve; otherwise proceed as for fruit juice. Process as directed in table 5.

TABLE 5.—*Timetable for processing fruits, tomatoes, and other acid foods*

The times given here for processing in the boiling-water bath apply only to places with altitudes of 1,000 feet or less. For all altitudes above 1,000 feet, the time should be increased 20 percent for each additional 1,000 feet.

When half-gallon glass jars are used, add 5 minutes to times given for pint and quart glass jars.

Process the containers immediately after packing.

Cool the food in tin cans in cold water immediately after processing.

Product	Style of pack	Processing period in boiling water 212° F.		Type of tin can
		Pint and quart glass jars	No. 2 and no. 3 tin cans	
		Minutes	*Minutes*	
Apples	Steam or boil to wilt; pack in hot sirup or water	15	10	Plain tin.
	Same as above but dry-pack	20	15	Do.
	Bake or boil whole; pack in hot sirup	5	5	Do.
	Apple sauce, pack hot	5	5	Do.
Apricots	Pack raw; cover with hot sirup	25	No. 2, 15 No. 3, 25	Do.
	Precook and pack hot	15	15	Do.
Beets, pickled	Pack hot	30		
Berries:				
Blackberries	Pack raw, cover with hot sirup	20	15	Sanitary enamel.
Blueberries	Precook and pack hot	5	5	Do.
Dewberries				
Huckleberries				
Logan blackberries				
Raspberries				
Cherries	Pack raw; cover with hot sirup	25	20	Do.
	Precook and pack hot	5	5	Do.
Currants	Precook and pack hot	5	5	Do.

Gooseberries	Pack raw; cover with hot sirup	20	15	Do.
	Precook and pack hot	5	5	Do.
Peaches	Pack raw; cover with hot sirup	Soft, 25 Firm, 35	Soft, 20 Firm, 30	Plain tin.
	Precook and pack hot	15	15	Do.
Pears	Pack raw; cover with hot sirup		No. 2, 20 No. 3, 25	Do.
	Precook and pack hot	20	20	Do.
Pimientos	Pack hot	Pint, 40	No. 0, 30 No. 1, 30	Sanitary enamel.
Pineapples	Pack raw; cover with hot sirup	30	25	Plain tin.
Plums	Pack raw; cover with hot sirup	20	15	Sanitary enamel.
	Precook and pack hot	5	5	Do.
Rhubarb	Precook and pack hot	5	5	Do.
Sauerkraut	Precook and pack hot	Pint, 25 Quart, 30	No. 2, 15 No. 3, 30	Plain tin.
Strawberries	Precook and pack hot	5	5	Sanitary enamel.
Tomatoes	Pack raw	45	35	Plain tin (preferred); or sanitary enamel.
	Precook and pack hot	5	5	
Tomato juice	Pack hot	No processing	5	Do.
Fruit juices:				
Berries Cherries Currants Plums	Pack at 160° to 170° F. and process in water bath at 180°.	20		
Fruit purees	Pack at 160° to 170° F. and process at 212°	20		

CANNING NONACID VEGETABLES

Nonacid vegetables require processing in the steam pressure canner at temperatures of 240° and 250° F. If a pressure canner is not available, then drying, brining, or some method of preservation other than canning should be used for these vegetables.

In estimating the approximate yield of canned products from raw vegetables the figures in table 6 are a guide.

TABLE 6.—*Approximate yield of canned products from raw vegetables*

Vegetable	Quantity raw	Yield as canned product
Asparagus, whole	2 pounds	1¼ pints or no. 2 can.
Beans, shelled, lima	do	1 quart or no. 3 can.
Beans, snap	1½ pounds	Do.
Beets, baby, without tops	2½ to 3 pounds	Do.
Corn	4 to 6 ears	1¼ pints or no. 2 can.
Greens	1 pound	Do.
Peas, green:		
In pods	2½ to 3 pounds	Do.
Shelled	1 pound	Do.
Pumpkin	4 pounds	1 quart or no. 3 can.
Sweetpotatoes	2½ to 3 pounds	Do.

DIRECTIONS FOR PACKING AND PROCESSING

Asparagus.—Select fresh and tender stalks, sort according to size, and wash thoroughly. Tie in uniform bundles, stand upright with tough portion in boiling water, cover tightly, and boil for 2 to 3 minutes. Or cut in half-inch lengths, add enough water to cover, and boil for 2 minutes in an uncovered vessel. Pack boiling hot into containers, cover with the water in which boiled, and add 1 teaspoon of salt to each quart. Or pack raw in no. 2 tin cans, cover with boiling water, and exhaust for 4 to 5 minutes before sealing. Process immediately as directed in table 7.

Beans, fresh lima.—Only young and tender lima beans should be canned; older ones may be dried. Shell, wash, and bring to a boil in water to cover. Pack hot into the containers, cover with hot water, and add 1 teaspoon of salt to each quart. Process immediately as directed in table 7.

Beans, snap.—Wash thoroughly and cut into pieces of desired size. Add boiling water to cover and simmer uncovered for about 5 minutes, or until the beans are wilted and will bend without breaking. Pack hot into the containers, cover with hot water, and add 1 teaspoon of salt to each quart. Process immediately as directed in table 7.

Beans, dried kidney or pinto.—Pick over the beans, wash, and soak overnight in a cool place. Drain. Blanch in boiling water for 3 to 4 minutes and drain. Fill at once into containers to about seven-eighths capacity. Cover with boiling water containing 2 ounces each of salt and sugar to the gallon. The sugar may be omitted or replaced by molasses if desired. Small pieces of salt pork may be added. Process immediately as directed in table 7.

Soybeans.—Either green or dried soybeans of varieties suitable for table use may be canned. The green soybeans make a better product, however, in both flavor and color. Follow the directions given above for kidney beans, except with green beans omit the over-

night soaking and do not add sugar. Salt pork may be added if desired.

Beets, baby.—Select young, tender beets preferably of the turnip-shaped varieties. Trim off the tops, but leave on at least 1 inch of the stems and all of the roots to prevent bleeding. Wash thoroughly and scald in boiling water or steam for about 15 minutes until the skins slip easily. After the beets are skinned and trimmed, pack into the containers, add 1 teaspoon of salt to each quart, and fill with hot water. Process immediately as directed in table 7. Pickled beets may be processed in the boiling-water bath (p. 20).

Carrots.—Young tender carrots may be canned in the same way as baby beets.

Corn.—Use only tender, freshly gathered sweet corn, shuck, silk, and clean carefully.

Sweet corn is canned in two styles—whole-grain and cream style. Whole-grain corn is cut from the cob without scraping, while for cream style the corn is given a more shallow cut and the cobs are scraped. Corn for the whole-grain pack should be gathered 3 or 4 days earlier than for cream style corn. The whole-grain product retains the appearance and flavor of fresh corn more nearly than the cream style because it can be given a lighter processing and therefore is not so likely to be overcooked. When cream-style corn, which is thick and viscous, is canned in glass jars, it sometimes becomes brownish in color because of the caramelization of the sugar by the heavy processing required. Whole-grain corn has less tendency to discolor when packed in plain tin cans than does cream-style corn, though the C enamel cans give better results for both.

For the whole-grain style cut the corn from the cob deeply enough to remove most of the kernels without objectionable hulls. Do not scrape the cobs. Add 1 teaspoon of salt to each quart of corn and half as much boiling water as corn by weight. Heat to boiling and pack into containers at once. Process immediately as directed in table 7.

For the cream style, with a sharp knife lightly cut off the tops of the kernels, and with the back of the knife scrape out the pulp. This gives a thick pasty mass with the minimum of hulls. Add 1 teaspoon of salt to each quart,and half as much boiling water as corn by weight. Heat to boiling, and fill into containers at once. Process immediately as directed in table 7.

Greens, including spinach.—Pick over the greens, discarding any imperfect leaves and tough fibrous stems. Wash carefully in running water or through a number of waters, lifting the greens out each time. To precook, cover the greens with water heated to simmering, not boiling, and cook in an uncovered vessel for 5 minutes, or until the greens are wilted. Pack hot into the containers, taking care not to make too solid a pack and to have sufficient hot liquid to cover the greens. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 7. Greens should not be canned in no. 3 tin cans, because of the difficulty of heat penetration.

TABLE 7.—*Timetable for processing nonacid vegetables in the steam pressure canner*

The processes given here apply to places with altitudes of 2,000 feet or less. At altitudes over 2,000 feet, add 1 pound pressure for each additional 2,000 feet. Follow the directions on pages 6 to 8, 10, and 14 for operation of canner and removal of jars and cans after processing. Cool tin cans in cold water immediately after processing.

Product	Pint glass jars		Quart glass jars		No. 2 tin cans		No. 3 tin cans		Type of tin can
	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	240° F., or 10 pounds pressure	250° F., or 15 pounds pressure	
	Minutes	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*	
Asparagus	30	------	35	------	30	------	------	----------	Plain tin.
Beans:									
Fresh lima	50	------	55	------	40	------	50	----------	C enamel or plain tin.
Snap	30	------	35	------	25	------	30	----------	Plain tin.
Dried kidney or pinto	80	------	90	------	70	------	85	----------	C enamel or plain tin.
Soybeans	80	------	90	------	70	------	85	----------	Do.
Beets, baby	30	------	35	------	30	------	30	----------	Sanitary enamel.
Carrots	30	------	35	------	30	------	30	----------	Plain tin.
Corn:									
Whole-grain	60	------	70	------	50	------	65	----------	C enamel.
Cream-style	------	75	------	------	------	70	------	----------	Do.
Greens, including spinach	------	60	------	65	------	55	------	No. 2½, 60	Plain tin.
Mushrooms	25	------	35	------	25	------	25	----------	Do.
Okra	35	------	40	------	25	------	30	----------	Do.
Okra and tomatoes	25	------	35	------	25	------	30	----------	Do.

Peas:									
Green	45				40				Do.
Black-eyed	50		55		40		50		Plain tin or C enamel.
Pumpkin		60		75		60		70	Sanitary enamel.
Squash		60		75		60		70	Do.
Sweetpotatoes	95		120		95		115		Do.
Vegetable-soup mixtures	60		70		50		65		Plain tin.

Mushrooms.—Wash thoroughly, peel mature mushrooms, and drop into water containing 1 tablespoon of vinegar per quart. Precook, place in a wire sieve or colander, cover with a lid to hold the mushrooms under water, and immerse for 3 to 4 minutes in boiling water that contains 1 tablespoon of vinegar and 1 teaspoon of salt per quart. Fill into containers at once and cover with freshly boiling water. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 7.

Okra.—Only young, tender pods should be canned; older pods should be dried. After the okra is washed, cover with water, bring to a boil, and pack hot into the containers. Add 1 teaspoon of salt to each quart. Process immediately as directed in table 7.

Okra and tomatoes.—Use only young, tender okra and sound, ripe tomatoes. Wash the okra and slice crosswise. Wash the tomatoes, remove the skins and cores, and cut into sections. Combine the okra and tomatoes and heat to the boiling point. Pack while hot, and add 1 teaspoon salt to each quart. Process immediately as directed in table 7.

Peas, green.—Use only young, tender peas. Shell, wash, add hot water to cover, and simmer for about 5 minutes. Pack hot in pint jars or no. 2 tin cans, cover with hot water, and add one-half teaspoon of salt to each pint. If tender peas are packed in quart jars or no. 3 cans they become overcooked and mushy. Process immediately as directed in table 7.

Peas, black-eyed.—Same as lima beans.

Pumpkin.—Wash, peel, and cut the pumpkin into 1- to 1½-inch cubes. Add a small quantity of water and simmer until heated through, stirring occasionally. Pack hot into containers, add 1 teaspoon of salt to each quart, and cover with the water in which cooked. Process immediately as directed in table 7.

Squash.—Same as pumpkin.

Sweetpotatoes.—Where sweetpotatoes can be stored successfully, only enough should be canned to take care of the season during which the stored potatoes are not available. Or if in harvesting more are cut with the plow than can be used immediately, they may be canned in order to save them. In this case, precook them slowly in order to develop the sugar.

Wash the sweetpotatoes thoroughly and boil or steam them until the skins slip off readily. Peel quickly, cut into medium-sized sections, and pack hot into containers. Add 1 teaspoon of salt to each quart and enough boiling water to cover. Process at once as directed in table 7.

Vegetable-soup mixtures.—The combinations of vegetables for soups may include two or more of the following: Tomato pulp, corn, lima beans, peas, okra, carrots, turnips, celery, onion, pimientos, and sweet and red peppers. Wash and trim the vegetables and cut into small pieces or cubes. Keep the diced carrots and turnips covered with water or weak brine to prevent darkening. Seasonings should be light, and may include sugar, salt, white pepper, dashes of cayenne and garlic, parsley, thyme, and bay leaf.

Bring the soup mixture to the boiling point, and pack hot, with sufficient liquid to cover the vegetables and prevent too dense a pack. Process as directed in table 7.

CANNING MEATS AND CHICKEN

Beef, veal, mutton, lamb, pork, and chicken may be canned successfully in the home, provided they are processed under steam pressure. The temperatures required for effective sterilization (240° to 250° F., corresponding to 10 and 15 pounds steam pressure) cannot be obtained inside the can or jar except by the use of the steam pressure canner. The water bath, the oven, and the steamer without pressure are inadequate for canning meats and cannot be used safely. Insufficiently processed meat may keep if stored at a low temperature, but even when no visible signs of spoilage are observed there is no certainty that the bacteria which cause food poisoning have not been active. If a pressure canner is not available, other methods of preservation should be used for meats.

While a variety of meat and poultry products may be canned, it is more economical of can or jar space to put up the meat alone and combine it with the other foods at the time of serving. This also permits greater variety in the use of the meat, and combinations with fresh, crisp vegetables as well as a wider choice of seasonings. Onion, garlic, and spices should be used sparingly, and white pepper retains a better flavor than black pepper in meat products.

All meats and poultry for canning should be slaughtered and handled in a strictly sanitary manner. Unless the meat is to be canned at once, chilling the carcass after slaughtering is necessary; otherwise decomposition will start within a few hours. There is little difference in the flavor or tenderness of the canned product whether the meat is chilled or unchilled. However, raw meat is easier to handle after chilling and may be held for a few days until convenient to can.

Frozen meat may be canned, but it does not make a high-quality product. If meat has become frozen, do not thaw it out before canning. Cut or saw the frozen meat into uniform strips 1 to 2 inches thick and plunge at once into boiling water. Simmer until the color of raw meat has almost disappeared; then pack and process.

Utensils for meat canning are preferably of enamelware, aluminum, retinned metal, or stainless metal. Copper and iron utensils may discolor canned meat and should not be used. Also meat must not be allowed to remain in contact with galvanized iron more than 30 minutes, or it may take up harmful quantities of zinc. Wooden utensils or surfaces require special care in cleaning to free them from bacteria. They should be scrubbed with soapy water to remove all grease and then rinsed with boiling water. If used for several days at a stretch they should be disinfected with a hypochlorite solution (calcium, potassium, or sodium hypochlorite) applied after the scrubbing and scalding.

Plain tin cans and glass jars are used for the home canning of meats and poultry. When canned in tin, chicken is more likely than other meats to discolor the cans, and sometimes there is a deposit on the chicken itself. If the directions given here are followed for packing the chicken hot and leaving proper head space in the containers, this discoloration will be reduced to a minimum. The C-enamel cans used for corn and the R- or sanitary-enamel cans for certain fruits are not suitable for chicken because the fat may cause the enamel to peel off and make the product unattractive although harmless.

In canning meat and poultry the head space is particularly important. If the liquid does not cover the meat it will discolor and lose flavor during storage. In packing containers allow the following head space: Glass jars, one-half inch; no. 1 tin cans, one-fourth inch; no. 2 tin cans, five-sixteenths inch; no. 3 tin cans, three-eighths to one-half inch.

The sizes of containers most suitable for meat products are no. 2 and no. 2½ tin cans, and pint glass jars. The no. 3 tin cans (quart) and quart glass jars require much heavier processing, and though times are given for them in table 8, their use is not recommended.

When glass jars are used, meats should be precooked in the oven or in water before being packed in the container. When tin cans are used, the meat may be precooked in either of these ways and packed hot, or it may be packed raw and the cans exhausted before being sealed. The latter method gives a little better flavored product and the liquid is all meat juice, but it takes more time and stove space. Frying is not recommended as a method of precooking meat for canning, because it makes the meat hard and dry and gives it a disagreeable flavor.

PRECOOKING IN THE OVEN

Cut the meat into uniform pieces weighing about 1 pound each, and cook in a moderate oven (350° F.) until the red or pink color of the raw meat almost disappears at the center. This requires about 30 to 40 minutes. Cut the meat so that there are two or more pieces to each container, pack at once closely, cover with the pan drippings or with boiling water, leaving proper head space, and process immediately.

Chicken is handled in this same way except that it needs only about 20 to 30 minutes because of the smaller size of the pieces. This is the best way to precook chicken for canning in glass.

PRECOOKING IN WATER

Cut the meat into uniform pieces weighing about 1 pound and place in boiling water. Partly cover the kettle and simmer for 12 to 20 minutes, until the color of the raw meat has almost disappeared from the center of the pieces. At this stage the meat has lost about one-third of its original weight because of the juice which has cooked out. At once cut the meat into smaller pieces, pack into the containers, and press the meat down closely with a wooden mallet or pestle. Cover with the broth, leaving proper head space, and process immediately.

This method, commonly referred to as parboiling, is the quickest way to precook a large quantity of meat. It is also used with chicken except that the time is only about 8 to 10 minutes.

PRECOOKING IN TIN CANS

This method can be used only with tin cans. Pack two or more pieces of meat into each can, and place the filled but open cans in a bath of boiling water that comes to within 1½ to 2 inches of the top of the can. Cover the bath to hold in steam and heat, being careful that water from the bath does not bubble into the cans. Continue heating until the meat is steaming hot, or 170° F., at the center of the cans, and has practically lost its color when raw. If no thermom-

eter is available, turn out the meat from a few of the cans to be sure it is heated through. The time required is about 40 to 50 minutes for no. 2 cans of beef or pork, and somewhat less for chicken. Press the meat down and be sure that it is covered with broth and that there is proper head space in the cans. Seal at once and process immediately.

SALTING

Salt is added to cans of meat as follows: One-half teaspoon to a pint jar, three-fourths teaspoon to a no. 2 can, and 1 teaspoon to a quart jar or no. 3 can. When tin cans are used, place the salt in the cans before packing them with meat. If the salt is placed on top of the meat, the lids sometimes rust.

DIRECTIONS FOR PACKING AND PROCESSING

Beef, fresh.—Select cuts of beef commonly used for roasts or steaks—round, rump, loin, rib, and chuck. Cuts that contain more connective tissue and bone may be canned as stew meat, hamburger, or other products utilizing small pieces or used in soups. Wipe the meat with a damp cloth, remove the bone and gristle, and leave only enough fat to give flavor. If using glass jars, precook in the oven or in water (p. 32), pack into containers, add salt, cover with broth, and process as directed in table 8. If using tin cans, follow the same method, or pack the meat raw and exhaust the cans (p. 32).

Beef, ground (hamburger).—Prepare hamburger by grinding the meat through a plate with ⅛-inch holes. Add 1 cup of salt for each 25 pounds of meat and mix well. Pack the cold meat tightly into tin cans and exhaust the cans until the meat is steaming hot (p. 32). If canning in glass jars, form the meat into cakes, precook in the oven, pack hot, and cover with broth. Process immediately as directed in table 8.

Beef, hash, and stew meat.—One way of utilizing small pieces of meat is to can it for combining later with potato in hash. Cut or chop the meat into uniformly small pieces. Add sufficient water to cover, bring to simmering, and cook for several minutes. Pack hot and process as directed in table 8.

For use in making stew, cut the meat into 1-inch cubes, cover with boiling water or broth, and simmer until the meat is shrunken and heated through. This requires about 8 to 10 minutes. The color of raw meat will have almost disappeared from the center of the pieces. Pack the drained meat closely into containers, add salt, and cover with boiling concentrated broth. Process immediately as directed in table 8.

Beef, heart and tongue.—The tongue and heart are generally used as fresh meat, but they may be canned as follows: Wash the tongue, drop into boiling water and simmer for about 45 minutes, or until the skin can be removed. Skin and cut into pieces that will fit into the containers. Reheat to simmering in broth, pack into containers; add salt and broth to cover. Process as directed in table 8.

Wash the hearts, remove the thick connective tissue, and cut into pieces suitable for packing. Drop into boiling water and simmer for 15 to 20 minutes. Pack at once; add salt and broth to cover. Process as directed in table 8.

Beef stew with vegetables.—Sprinkle the stew meat with salt and white pepper and dredge with flour. Brown the meat in hot beef fat; then add a small quantity of chopped onion and brown. Remove from the heat. Prepare a mixture of tomato pulp and equal parts of diced carrots, diced turnips, and diced potatoes. Add hot water and bring to boiling. Add the meat mixture and more salt and white pepper if needed. Pack hot, and process as directed in table 8.

Beef, corned.—Wash the corned beef, cover with cold water, bring to the boiling point, and drain. Cover the meat again with cold water, bring to the boiling point, then lower the heat and simmer until the meat is thoroughly heated through. Remove the meat from the broth a piece at a time, and while it is still hot cut into smaller pieces, and pack into the containers. Season the broth as desired, with bay leaves, cloves, or nutmeg. Sometimes gelatin softened in a little cold water is added. Pour boiling broth over the meat to cover. Process as directed in table 8.

Chicken and other poultry.—For canning select plump, 2-year-old hens, preferably when they are culled from the flock during July and August. Young birds may be canned, but the texture and flavor of the meat is not so good as that from mature birds.

Dress the chickens as for cooking, and take particular care not to break the gall bladder because the meat is then unfit for canning. Also remove the lungs, kidneys, and eggs. Cut the chicken into the usual-sized pieces for serving and separate into three piles—the meaty pieces (breasts, thighs, legs, and upper-wing joints), the bony pieces (backs, wings, necks, and perhaps the feet after they have been skinned), and the giblets.

The giblets should not be canned with the other meat as they will flavor and discolor it. Also it is better to can the livers alone, and the gizzards and hearts together. Remove the chicken skin or not as desired, and trim off lumps of fat. Too much fat makes chicken difficult to process.

Make broth with the bony pieces. Cover with lightly salted cold water, simmer until the meat is tender, and drain off the broth to use as the liquid in canning the meaty pieces. Strip the meat from the bones and can as small pieces or use in making sandwich spread.

If desired add 5 tablespoons of granulated gelatin to each quart of broth. Moisten the gelatin first with a little of the cold liquid and dissolve in the hot broth.

The meaty pieces of chicken may be canned either with or without the bone. With the bone the product is better flavored. Precook in the oven or in water and pack hot as described on page 32. Or exhaust in tin cans until steaming hot (p. 32). Add salt according to the size of the container (p. 33), and process as directed in table 8.

Precook giblets in water and pack hot, or exhaust in tin cans, and process as directed in table 8.

Chicken sandwich spread.—This is a good way to utilize the small bits of meat stripped from the bony pieces.

4 pounds cooked chicken, chopped or ground.
1½ pounds olives, chopped.
1 pound pimientos, cut in small pieces.
1 quart chicken broth.
½ teaspoon curry powder.
1 teaspoon ground mace.
1 teaspoon ground mustard.
Salt and white pepper, to taste.

Combine all of the ingredients, stir, and heat gradually to simmering. Pack hot and process immediately as directed in table 8.

Chicken-liver paste.—Chicken livers may be made into a paste for sandwiches. Simmer the livers for 10 minutes and drain. Mash with a fork and remove any stringy tissue. Then add a small quantity of finely chopped olives, mayonnaise, and dashes of tabasco sauce and paprika. Stir while heating carefully to prevent scorching. Pack hot and process as directed in table 8.

Chicken-gumbo soup.—Prepare chicken-gumbo soup by any tested recipe. Pack hot into the containers and process by the directions given in table 8.

Chili con carne.—Use 2 pounds of chili beans or some other pink or red variety. Pick over the beans, wash, and soak overnight in a cool place. Remove thick connective tissue from 5 pounds of lean beef, or beef and pork mixed, and grind coarsely or chop. Add a little chopped garlic, 3 to 5 tablespoons of chili powder, 3 tablespoons of salt, and one-half cup of wheat flour, and mix well with the meat. Cook the mixture in 1 cup hot beef fat until the red color of the meat disappears. Add 2 quarts hot water, cover, and simmer for about 10 minutes. Drain the beans and blanch for 5 minutes in boiling water. Drain. Fill cans or jars about one-third full of the hot beans. Add the hot meat mixture to about seven-eighths of capacity, then hot water to fill. Process immediately as directed in table 8.

Lamb and mutton.—Select the fleshy parts and follow the same method as for beef, page 33. Can the smaller pieces as stew meat (p. 33).

Liver paste.—Beef, calf, lamb, or hog liver may be used in this way.

- 3 pounds liver.
- 1½ pounds fat fresh pork.
- 2 tablespoons salt.
- 1 teaspoon white pepper.
- ½ teaspoon ground cloves.
- 1 medium sized onion, chopped.
- 3 eggs.
- 6 tablespoons fine dry bread crumbs.
- ½ cup water.

Wash the liver thoroughly and remove veins and membranes. Grind the raw liver and pork twice through a plate with ⅛-inch holes, to make it very smooth. Add the seasonings. Beat the eggs well and combine with the bread crumbs and water. Stir all ingredients together until well mixed. Pack into no. 2 cans leaving 1 inch of head space, and exhaust until the paste is heated through to the center of the cans. This requires about 40 to 50 minutes (p. 33). Remove some of the paste or add a little hot water if necessary so that the cans have the proper head space before sealing. Process as directed in table 8.

Pork and beans.—Pick over white navy beans, wash, and soak in a cool place for about 16 hours, or overnight. Drain. Prepare liquid to cover the beans, using the proportion of 1 quart of water, 1 tablespoon of salt, and 1 tablespoon of sugar (or molasses) to each pound of dry beans. Or prepare an equal quantity of tomato sauce, using 3 cups of tomato pulp to 1 cup of water. Add ground spices, cayenne pepper, and chopped garlic or onion, as desired. Cook until thick.

Blanch the beans for 2 minutes in boiling water, and drain. Place small pieces of salt pork in a bean pot or other container for baking. Add the beans and additional pieces of salt pork, and cover with the prepared liquid or tomato sauce. Cover the pot and cook the beans in a slow oven (about 250° F.) for 1½ hours. Remove the lid and

cook one-half hour longer. Pack hot in the containers and cover with the liquid or sauce. Process immediately as directed in table 8.

Pork, fresh.—The cuts of pork usually canned are the following: Loin; meat from spareribs; head, tongue, and heart in headcheese; loin and lean trimmings in sausage; and liver in liver paste. While the ham and shoulder may be canned, they are generally preserved by curing.

Remove excess fat from the meat to be canned and precook by any of the methods described on page 32. Pack hot and process as directed in table 8.

Pork, headcheese.—Headcheese may be made from a hog's head, tongue, and heart, according to any good recipe but omitting the sage. Pack the headcheese hot into containers and process as directed in table 8. It is better to use tin cans so that the product can be removed in a single piece.

Pork sausage.—Follow any tested formula for preparing the sausage, but omit the sage for that gives the sausage a bitter flavor after processing. See that the seasonings and meat are well mixed together.

If using tin cans, pack the raw sausage closely into the no. 2 size and exhaust the cans until the sausage is steaming hot, as directed on p. 32. This requires 40 to 50 minutes. Process as directed in table 8. Before opening a can heat for a few minutes in boiling water, then slip the contents of the can out in one piece, slice into rounds, and reheat in gravy or in an oven.

If glass jars are used, mold the sausage into cakes and precook in a moderate oven (350° F.) for 10 to 15 minutes, or until the cakes are slightly browned and the color of raw meat has almost disappeared. Pack into the jars and cover with the drippings or with hot water. Process as directed in table 8.

Rabbit, domestic.—Precook and process in the same way as chicken (table 8).

Soup stock and broth (chicken or meat).—Broth containing small pieces of meat and sediment from coagulated proteins is commonly called soup stock. Clear meat broths for canning should be fairly concentrated but avoid prolonged boiling as it will cause loss of flavor. Also, if meat bones are cooked for a long time under pressure to make broth or soup stock, the broth will have a disagreeable gluey flavor. Remove excess fat from broth or soup stock before canning.

Rice or barley may be added to the broth in the proportion of 1 cup of the uncooked cereal to each gallon of clear meat broth. Wash the cereal, boil for 15 minutes in salted water, drain, and rinse with cold water. Bring the meat broth to the boiling point and add the cereal. Season as desired. Process as directed in table 8.

Veal.—Same as beef, fresh.

TABLE 8.—*Timetable for processing meats and chicken in the steam pressure canner*

At altitudes over 2,000 feet, add 1 pound of pressure for each additional 2,000 feet. Follow the directions given on pages 6 to 14 for operation of canner and removal of jars and cans after processing. Cool tin cans in cold water.

250° F., OR 15 POUNDS PRESSURE

Product	No. 2 can	No. 2½ can	No. 3 can	Pint glass jar	Quart glass jar
Beef:	*Minutes*	*Minutes*	*Minutes*	*Minutes*	*Minutes*
Fresh	85	110	120	85	120
Ground (hamburger)	90	115	------	90	120
Hash	90	115	------	90	120
Heart and tongue	85	110	120	85	120
Stew meat	85	110	120	85	120
Stew with vegetables	85	110	120	85	120
Corned	85	110	120	85	120
Chicken and other poultry:					
With bone	55	65	70	65	75
Boned	85	110	120	85	120
Giblets	85	------	------	85	------
Sandwich spread	No. 1, 55 No. 2, 90	------	------	½-pint, 65 Pint, 90	------
Liver paste	No. 1, 55 No. 2, 90	------	------	½-pint, 65 Pint, 90	------
Lamb and mutton	85	110	120	85	120
Liver paste	90	------	------	90	------
Pork:					
Fresh	85	110	120	85	120
Headcheese	90	------	------	90	------
Sausage	90	115	------	90	120
Rabbit, domestic	85	110	120	85	120
Soups:					
Broth, clear	25	30	30	25	30
Broth with rice or barley	35	40	40	35	40
Chicken gumbo	65	75	80	65	80
Soup stock	40	45	45	40	45
Veal	85	110	120	85	120

240° F., OR 10 POUNDS PRESSURE

Chili con carne	120	135	150	120	150
Pork and beans	70	80	85	80	90

OTHER BULLETINS ON FOOD PRESERVATION

United States Department of Agriculture:

Farmers' Bulletin No. 879, Home Storage of Vegetables.
Farmers' Bulletin No. 900, Homemade Fruit Butters.
Farmers' Bulletin No. 984, Farm and Home Drying of Fruits and Vegetables.
Farmers' Bulletin No. 1186, Pork on the Farm—Killing, Curing, and Canning.
Farmers' Bulletin No. 1415, Beef on the Farm—Slaughtering, Cutting, Curing.
Farmers' Bulletin No. 1438, Making Fermented Pickles.
Farmers' Bulletin No. 1800, Home-made Jellies, Jams, and Preserves.
Farmers' Bulletin No. 1807, Lamb and Mutton on the Farm.

United States Department of Commerce: Bureau of Fisheries Investigational Report No. 34, The Home Canning of Fishery Products.

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